Chapter Fourteen

INTERSECTION DESIGN STUDIES

BUREAU OF DESIGN AND ENVIRONMENT MANUAL

Chapter Fourteen
INTERSECTION DESIGN STUDIES

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Chapter Fourteen
INTERSECTION DESIGN STUDIES

An Intersection Design Study (IDS) is a graphic representation of a proposed treatment for the development or improvement of an intersection facility. It is based on an analysis of traffic needs and an evaluation of physical and economic elements at the intersection site. Chapter 14 presents the Department's criteria for the preparation of an IDS. Chapter 36 presents the detailed design criteria for intersections.

The primary purpose of an IDS is to provide a review medium for use by the district, BDE, and the general public. The IDS also provides a file reference that documents all pertinent data and information controlling the design of the intersection improvement.

14-1 WARRANTS FOR THE PREPARATION OF INTERSECTION DESIGN STUDIES

Prepare an IDS for intersections if any of the following conditions apply:

- The study location is an intersection of two marked routes.
- The improvement is intersected by either:
  - a rural highway that has an existing 30th maximum hourly volume greater than 300 vehicles or additional lanes and/or channelization is proposed on one or both routes; or
  - an urban highway that has an existing 30th maximum hourly volume greater than 400 vehicles or additional lanes and/or channelization is proposed on one or both routes.
- Where complex conditions exist at the intersection (e.g., high crash rate, adverse terrain features, geometric features that will be difficult to correct due to the extent of cultural development).
- Where a roundabout is proposed.
- When requested by the district or BDE in accordance with the engineering study and advance engineering data requirements in the ILMUTCD.

14-2 PREPARATION OF INTERSECTION DESIGN STUDIES

14-2.01 Signalized, Two-way Stop controlled, and All-way Stop-controlled Intersections

Prepare IDS plan sheets on CADD. For guidance on the preparation of plan or profile sheets, see Section 63-4.01. A sample intersection design study for a signalized intersection is illustrated in Figure 14-2.A. To facilitate uniformity, use the following sheet formats:

1. Cover Sheet. The cover sheet layout for two-way stop-controlled and all-way stop-controlled intersections is generally similar, with different Capacity Design Analysis, Elements Controlling Design, and General Notes blocks. In urban areas, the intersection layout is usually drawn at a scale ratio of 1 in = 50 ft (1:500 metric) and in rural areas 1 in = 100 ft (1:1000 metric) or 1 in = 50 ft (1:500 metric). The cover sheet contains the following items:

   - scaled plan view layout of the intersection (including traffic signal locations, if proposed, and striping plan),
   - Capacity Design Analysis table,
   - DHV turning movement diagram,
   - graphic bar scale,
   - Traffic Data table,
   - north arrow,
   - phasing diagram,
   - location map box,
   - existing and proposed right-of-way,
   - Elements Controlling Design data block,
   - General Notes data block,
   - property lines, natural features, and manmade cultural developments, and
   - signature and title block in the lower right-hand corner.

2. Intersection Detail Sheet(s). These sheets are supplemental sheets for intersection details. They may not be necessary (for simple intersections), be a single page or be multiple pages. The need to show special details or cross sections depends on the complexity and size of the intersection. These sheets contain improvements to the approach legs, beyond the intersection proper, when they cannot fit on the cover sheet. In urban areas, the scale ratio is usually 1 in = 20 ft (1:250 metric) and in rural areas 1 in = 50 ft (1:500 metric). Also include the following items on each sheet:

   - graphic bar scale,
   - title block in the lower right-hand corner, and
   - sheet index block in the upper right-hand corner indicating the route, section, county, and sheet numbers.

3. Profile Sheets. Typical grid sheets are used for showing profiles, if profiles are necessary. Use the format illustrated in Figure 14-2.B. Also include the following items on the sheet:

- title block in the lower right-hand corner; and
- sheet index block in the upper right-hand corner indicating the route, section, county, and sheet numbers.

4. Design Vehicle Turning Path Sheets. Include the design vehicle turning paths if generated by computer software.

14-2.02 Roundabout Intersections

1. Cover and Intersection Detail Sheets. Information on these sheets of a roundabout IDS is similar as that described above for signalized intersections

2. Other Sheets.

   - Include the baselines of the approach roadways and the central island. The baselines of the approach roadways should follow the median edges of the approaches and be defined by tangents and curve data. Both edges of the median should have a baseline as the alignment of the approaches and departures are independent. Once the baselines reach the outside edge of the circulatory roadway, it should break directly toward the center of the central island. Include a station equation at the center of the central island where the other baselines intersect. The baseline of the central island should be along the outside of the truck apron.

   - Include the profiles of the approach roadways along the baselines up to the intersection of the baseline of the central island. Include the profile of the central island along the baseline of the central island. Include the stations equations and elevations at the intersection of the profile of the approach baselines and the profile of the central island.

   - Include the design vehicle turning paths for all movements from all approaches.

   - Include the fastest paths. Include the radii of the curves and the design speed.

   - Include the sight lines for the approaches to show there is adequate intersection sight distance for drivers to perceive and react to the presence of conflicting vehicles, pedestrians, and bicyclists. Evidence suggests that it is advantageous to provide no more than the minimum required sight distance on each approach. Excessive intersection sight distance can lead to higher vehicle speeds that reduce the safety of the intersection for all users.

   - Include the phi (Φ) angle. Defined in Section 36-9.04(h), the phi angle should range between 20° and 40°.

   - Show the existing and proposed right-of-way, if not shown on Sheet No. 1.

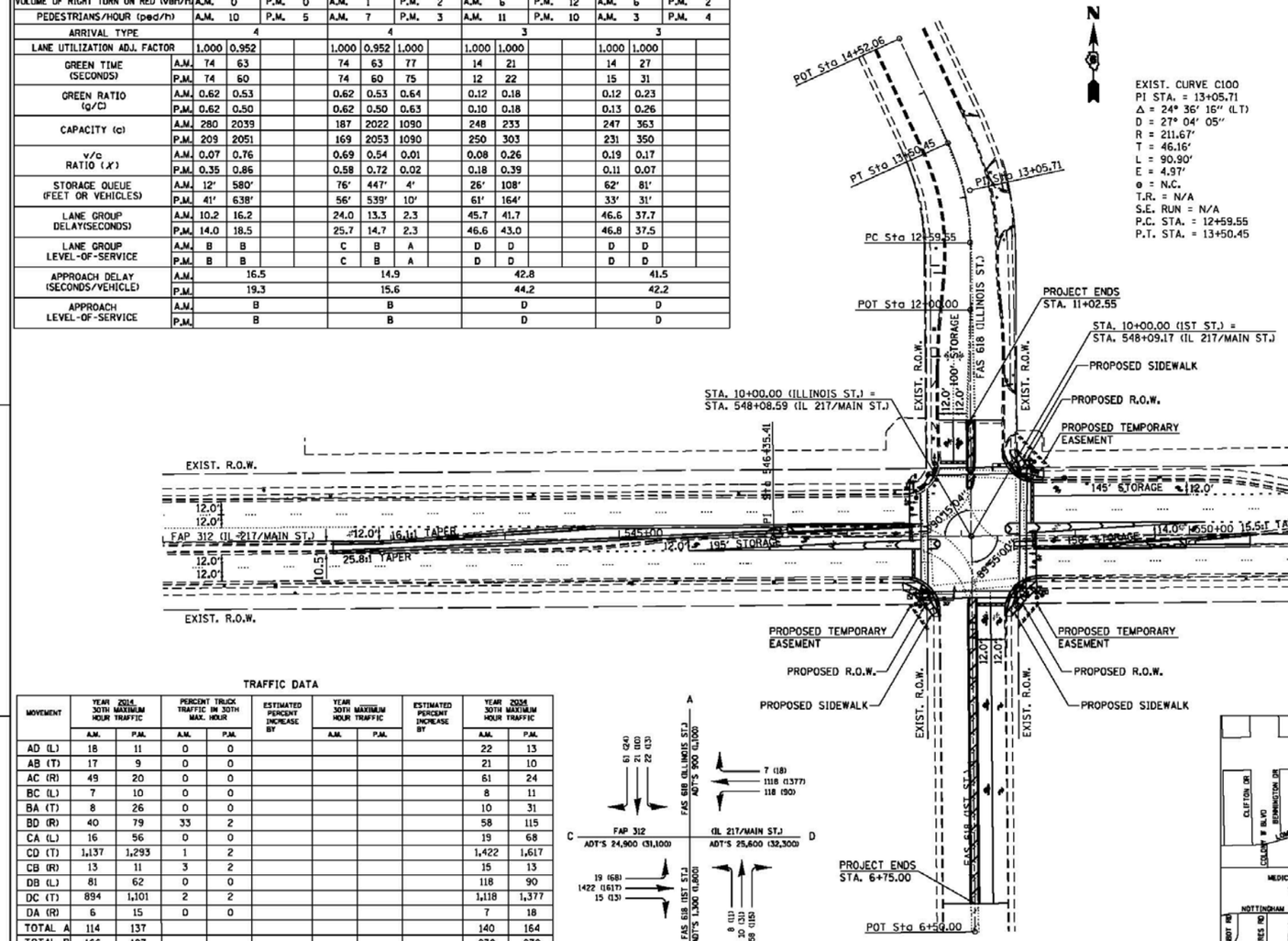
   All of the above sheets should have the title block in the lower right-hand corner and sheet index block in the upper right-hand corner indicating the route, section, county, and sheet numbers.

SIGNALIZED CAPACITY DESIGN ANALYSIS

PROGRAM USED: HCS 2010 , VERSION: 6.5 SIGNAL TYPE: ACTUATED AREA TYPE: NON-CBD
NUMBER OF PHASES: (A.M.) 4 (P.M.) 4 CYCLE LENGTH: (A.M.) 120 SEC. (P.M.) 120 SEC. PEAK HOUR FACTOR: 0.95
INTERSECTION DELAY/LEVEL-OF-SERVICE A.M. 17.4 SECONDS LOS B P.M. 19.1 SECONDS LOS B

APPROACH		EASTBOUND (C)				WESTBOUND (D)				NORTHBOUND (B)				SOUTHBOUND (A)			
LANE GROUP		L	TR			L	T	R		LT	R			LT	R		
NUMBER OF LANES		1	2			1	2	1		1	1			1	1		
2034 30TH MAX. HOUR TRAFFIC (veh/h)	A.M.	19	1437			118	1118	7		18	58			43	61		
	P.M.	68	1630			90	1377	18		42	115			23	24		
BASE SATURATION FLOW RATE (veh/h)		1900	2000			1900	2000	1900		1900	1900			1900	1900		
LANE WIDTH (FT)		12	12			12	12	12		12	12			12	12		
VOLUME OF RIGHT TURN ON RED (veh/h)		A.M. 0		P.M. 0		A.M. 1		P.M. 2		A.M. 6		P.M. 12		A.M. 6		P.M. 2	
PEDESTRIANS/HOUR (ped/h)		A.M. 10		P.M. 5		A.M. 7		P.M. 3		A.M. 11		P.M. 10		A.M. 3		P.M. 4	
ARRIVAL TYPE		4				4				3				3			
LANE UTILIZATION ADJ. FACTOR		1.000	0.952			1.000	0.952	1.000		1.000	1.000			1.000	1.000		
GREEN TIME (SECONDS)	A.M.	74	63			74	63	77		14	21			14	27		
	P.M.	74	60			74	60	75		12	22			15	31		
GREEN RATIO (g/C)	A.M.	0.62	0.53			0.62	0.53	0.64		0.12	0.18			0.12	0.23		
	P.M.	0.62	0.50			0.62	0.50	0.63		0.10	0.18			0.13	0.26		
CAPACITY (c)	A.M.	280	2039			187	2022	1090		248	233			247	363		
	P.M.	209	2051			169	2053	1090		250	303			231	350		
v/c RATIO (X)	A.M.	0.07	0.76			0.69	0.54	0.01		0.08	0.26			0.19	0.17		
	P.M.	0.35	0.86			0.58	0.72	0.02		0.18	0.39			0.11	0.07		
STORAGE QUEUE (FEET OR VEHICLES)	A.M.	12'	580'			76'	447'	4'		26'	108'			62'	81'		
	P.M.	41'	638'			56'	539'	10'		61'	164'			33'	31'		
LANE GROUP DELAY(SECONDS)	A.M.	10.2	16.2			24.0	13.3	2.3		45.7	41.7			46.6	37.7		
	P.M.	14.0	18.5			25.7	14.7	2.3		46.6	43.0			46.8	37.5		
LANE GROUP LEVEL-OF-SERVICE	A.M.	B	B			C	B	A		D	D			D	D		
	P.M.	B	B			C	B	A		D	D			D	D		
APPROACH DELAY (SECONDS/VEHICLE)	A.M.	16.5				14.9				42.8				41.5			
	P.M.	19.3				15.6				44.2				42.2			
APPROACH LEVEL-OF-SERVICE	A.M.	B				B				D				D			
	P.M.	B				B				D				D			

PHASE	1			2			3			4			
GREEN TIME IN SECONDS	A.M.	7	4	0	63	4	2	14	4	2	14	4	2	120 SEC.
	P.M.	10	4	0	60	4	2	12	4	2	15	4	2	120 SEC.



TRAFFIC DATA

MOVEMENT	YEAR 2014 30TH MAXIMUM HOUR TRAFFIC		PERCENT TRUCK TRAFFIC IN 30TH MAX. HOUR		ESTIMATED PERCENT INCREASE BY	YEAR ____ 30TH MAXIMUM HOUR TRAFFIC		ESTIMATED PERCENT INCREASE BY	YEAR 2034 30TH MAXIMUM HOUR TRAFFIC	
	A.M.	P.M.	A.M.	P.M.		A.M.	P.M.		A.M.	P.M.
AD (L)	18	11	0	0					22	13
AB (T)	17	9	0	0					21	10
AC (R)	49	20	0	0					61	24
BC (L)	7	10	0	0					8	11
BA (T)	8	26	0	0					10	31
BD (R)	40	79	33	2					58	115
CA (L)	16	56	0	0					19	68
CD (T)	1,137	1,293	1	2					1,422	1,617
CB (R)	13	11	3	2					15	13
DB (L)	81	62	0	0					118	90
DC (T)	894	1,101	2	2					1,118	1,377
DA (R)	6	15	0	0					7	18
TOTAL A	114	137							140	164
TOTAL B	166	197							230	270
TOTAL C	2,166	2,491							2,643	3,110
TOTAL D	2,176	2,561							2,745	3,230

T = THROUGH, L = LEFT, R = RIGHT

ELEMENTS CONTROLLING DESIGN

PREFERRED ROUTE:

F.A. ROUTE NUMBER: FAP 312. MARKED ROUTE NUMBER: IL 217
STREET NAME: MAIN ST. SRA ROUTE: NO
FUNCTIONAL CLASSIFICATION: OTHER PRINCIPAL ARTERIAL. OSOW DESIGN: NO
EXISTING ADT: 25,600 VPD. DESIGN YEAR ADT: 32,300 VPD.
PROPOSED DESIGN SPEED: 45 MPH. PROPOSED POSTED SPEED: 40 MPH.

SECONDARY ROUTES:

ROUTE NUMBER: FAS 618. MARKED ROUTE NUMBER: N/A.
STREET NAME: ILLINOIS ST. SRA ROUTE: NO
FUNCTIONAL CLASSIFICATION: URBAN STREET. OSOW DESIGN: NO
EXISTING ADT: 900 VPD. DESIGN YEAR ADT: 1,100 VPD.
PROPOSED DESIGN SPEED: 30 MPH. PROPOSED POSTED SPEED: 25 MPH.

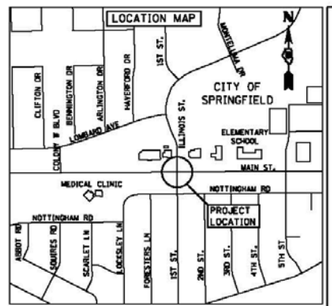
ROUTE NUMBER: FAS 618. MARKED ROUTE NUMBER: N/A.
STREET NAME: 1ST ST. SRA ROUTE: NO
FUNCTIONAL CLASSIFICATION: URBAN STREET. OSOW DESIGN: NO
EXISTING ADT: 1,300 VPD. DESIGN YEAR ADT: 1,800 VPD.
PROPOSED DESIGN SPEED: 30 MPH. PROPOSED POSTED SPEED: 25 MPH.

IMPROVEMENT TYPE: HSIP & 3P RESURFACING. ANTICIPATED YEAR OF CONSTRUCTION: FY 2014.
EXISTING METHOD OF TRAFFIC CONTROL: TRAFFIC SIGNALS. PROPOSED METHOD: TRAFFIC SIGNALS.
SIGNAL WARRANT: EXISTING SIGNALS.
DESIGN VEHICLE: WB-50 DESIGN VEHICLE WAS UTILIZED AT THIS INTERSECTION.
DESIGN YEAR: 2034 WHICH IS A 20 YEAR DESIGN.
TRUCK ROUTE DESIGNATION: PREFERRED ROADWAY: IL 217/MAIN ST.
SECONDARY ROADWAY: ILLINOIS ST.
DESIGN CRITERIA: URBAN 3R.

GENERAL NOTES

ARE PROFILES PROVIDED: YES. IF NOT, STATE REASON WHY: N/A.
TYPE B-6.24 CURB AND GUTTER ON THE OUTSIDE OF THE ROADWAY/SHOULDERS.
TYPE M-6.24 CURB AND GUTTER ON THE APPROACH MEDIAN.
TYPE N/A CURB AND GUTTER ON THE CORNER ISLANDS.
ALL DIMENSIONS ARE E-E OF PAVEMENT, UNLESS OTHERWISE NOTED.
THE RIGHT-OF-WAY LIMITS ARE PRELIMINARY.
DESIGN VEHICLE TURNING MOVEMENTS ARE ACCOMMODATED PER AUTOTURN SOFTWARE, VERSION 8.1.1.
THE SCOPE OF WORK: MEDIAN RETROFIT TO IMPROVE MAINLINE LEFT TURN SIGHT DISTANCE, TRAFFIC SIGNAL MODIFICATIONS TO IMPLEMENT FLASHING YELLOW ARROW, RESURFACING AND ADA IMPROVEMENTS.
INTERSECTION DESIGN EXCEPTIONS: NONE
ADDITIONAL NOTES: NONE.

50 0 50
GRAPHIC SCALE



INTERSECTION DESIGN STUDY

FAP ROUTE 312 (IL 127/MAIN ST.)
WITH
NORTH LEG: FAS 618 (ILLINOIS ST.)
SOUTH LEG: FAS 618 (1ST ST.)
SEC. NO. (27)RS-2,TS-1 PROJ. NO. D670123
SCALE 1"=50' COUNTY SANGAMON
SJN : D-96-997-12 REV. NO. ___
DESIGNED BY _____ DATE _____
SATISFACTORY _____ DISTRICT GEOMETRICS ENGINEER DATE
SATISFACTORY _____ DISTRICT PROGRAM DEVELOPMENT ENGINEER DATE
SATISFACTORY _____ DISTRICT OPERATIONS ENGINEER DATE
APPROVED _____ DEPUTY DIRECTOR OF HIGHWAYS, REGION ENGINEER DATE
CADD FILE NAME = ( ) I.D.S. SHEET 1 OF 5
BDE-9906

PLOT DATE =
FILE NAME =
PLOT SCALE =
USER NAME =

SIGNALIZED INTERSECTION DESIGN STUDY
Figure 14-22.A

SIGNALIZED INTERSECTION DESIGN STUDY

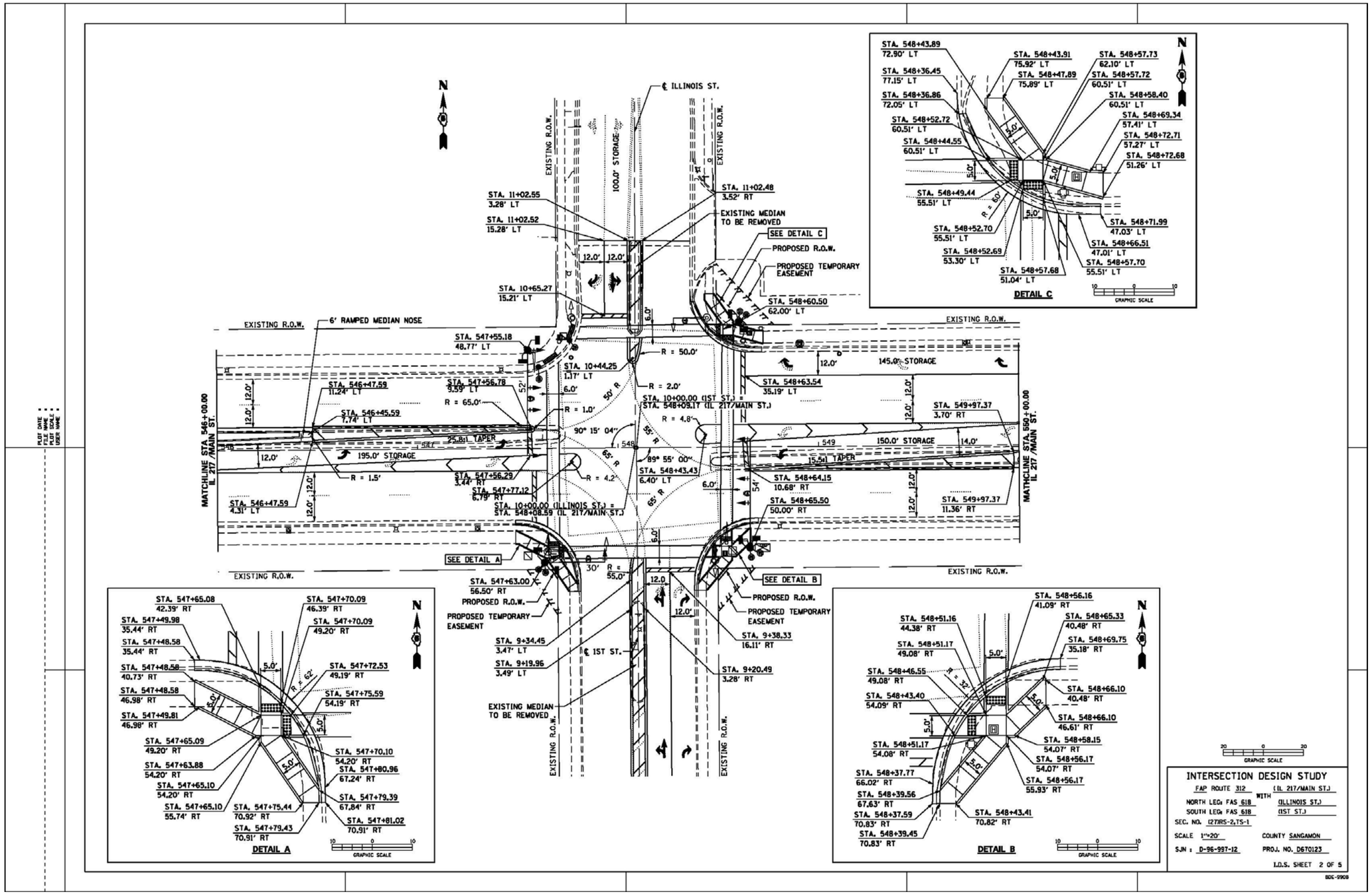
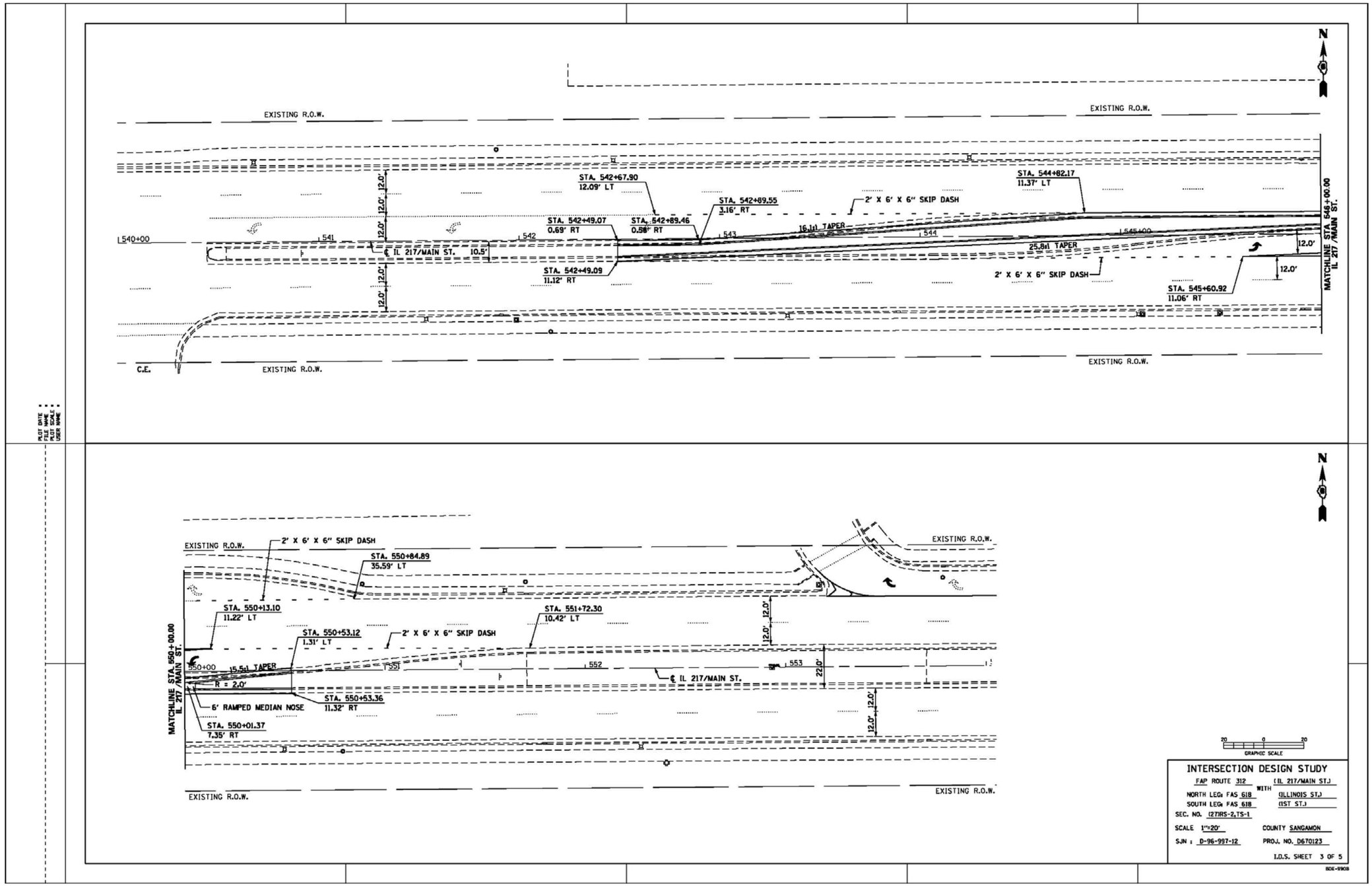
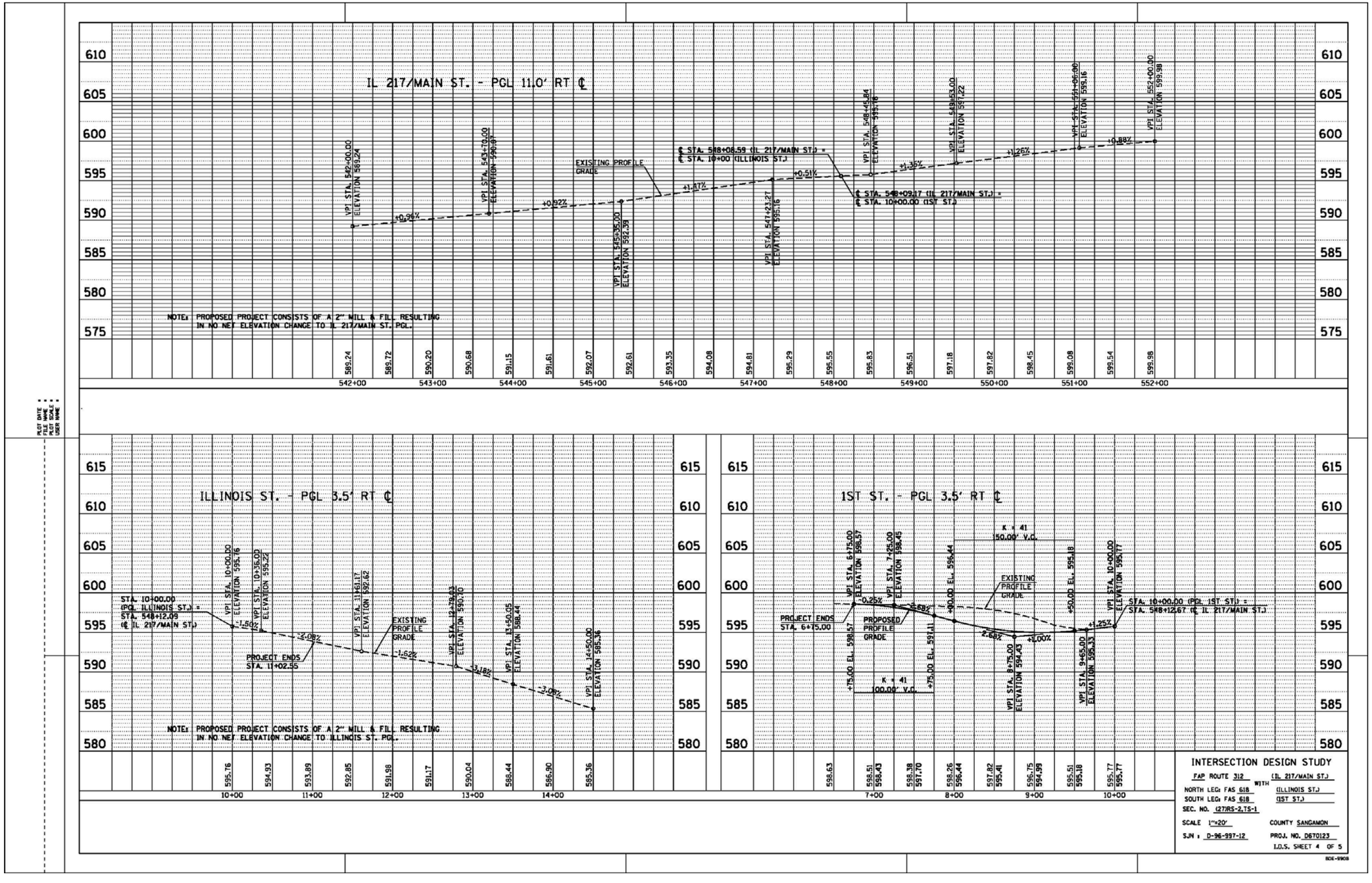


Figure 14-22.B
(Continued)



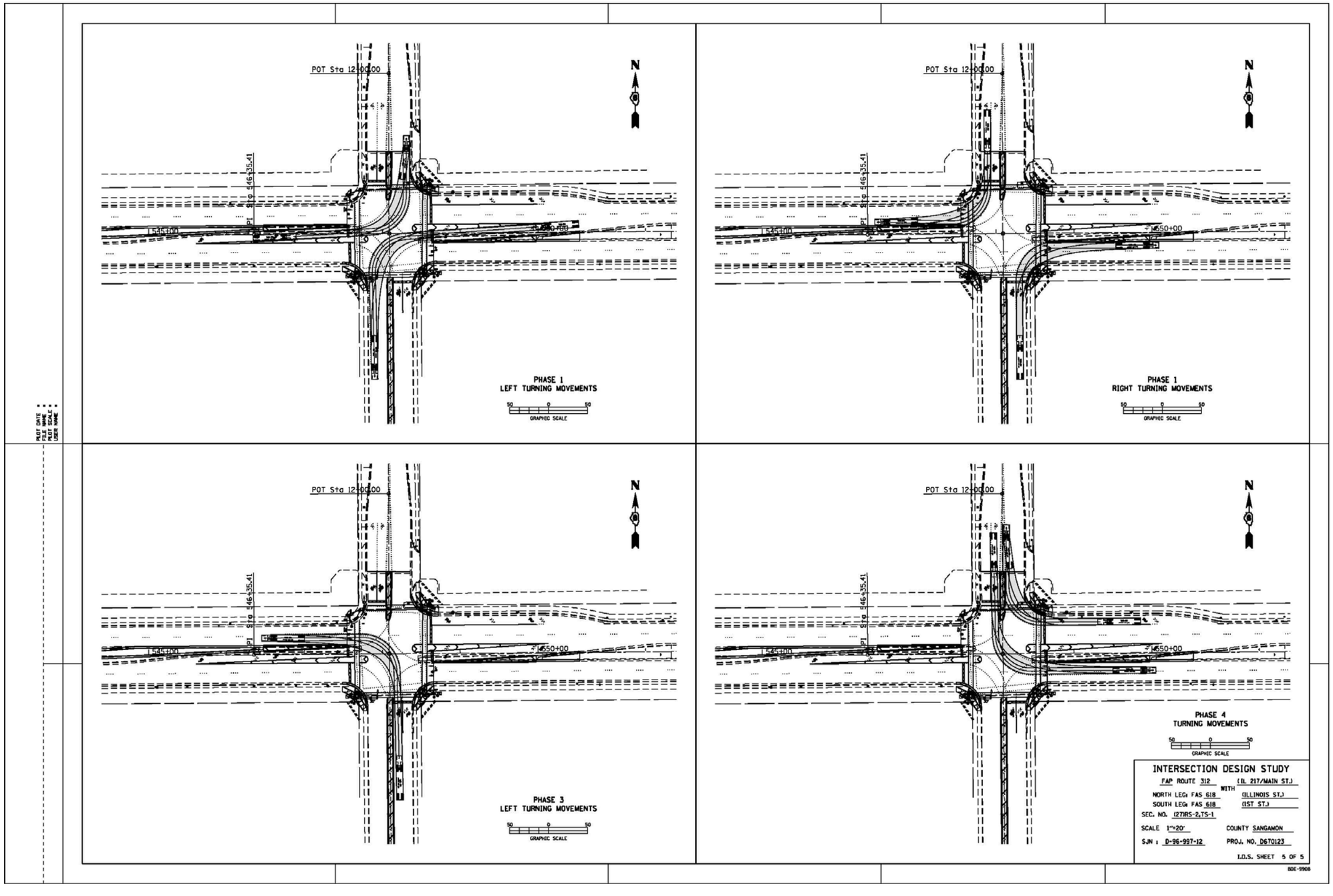
SIGNALIZED INTERSECTION DESIGN STUDY

Figure 14-22.C (Continued)



SIGNALIZED INTERSECTION DESIGN STUDY

Figure 14-22.D
(Continued)



SIGNALIZED INTERSECTION DESIGN STUDY

Figure 14-22.E
(Continued)

14-3 DATA REQUIRED FOR INTERSECTION DESIGN STUDIES

Document the following data in the IDS:

1. Elements Controlling Design. Chapter 36 presents the design criteria for intersections. On the cover sheet, list all pertinent elements affecting the design of the intersection including:

   - the route designation including highway functional classification for both intersecting routes, where applicable,
   - SRA Route designation, if appropriate,
   - existing and design traffic (ADT) for both intersecting routes;
   - the preferential route;
   - design year and the number of years for which the project is designed,
   - the anticipated year of construction;
   - the type of existing and proposed traffic control including:
     + a statement indicating whether signals will be installed or adjusted;
     + the signal warrant (only one is necessary) from the *ILMUTCD* justifying the use of signal control, or whether new signal installations are a special request; and
     + use of a roundabout;
   - design criteria;
   - Improvement Type. List the type of improvement (e.g., new construction, reconstruction, 3R, safety).
   - design vehicle;
   - truck route designation and whether the routes are to be designed for oversize/overweight vehicles (OSOW), and
   - existing and proposed posted and design speeds on all intersection approaches.

2. General Notes. Include the following information in the general notes on the cover sheet:

   a. Grades. Where all existing grades to remain are greater than 1% or in all cases with any new or altered grades, include a statement that profiles are shown for both intersecting roads and show them on a subsequent sheet. If existing grades

are to remain and are all less than 1%, including profiles is optional. Indicate this fact if profiles are not included for these reasons.

b. Curb and Gutter. Indicate the type of curb and gutter to be used on the outer edges of the traveled way, shoulders, channelizing islands, and corner islands.

c. Dimensions. Indicate the type of dimensioning used (e.g., edge-to-edge of pavement, edge-to-edge of traveled way).

d. Design Exceptions. List design exceptions that affect the intersection from design criteria and typical traffic control practice (e.g., large truck turning encroachments, lane widths less than Department criteria, less than desirable level of service, less than desirable storage length for queued vehicles). Include the justification for the design exceptions in the Phase I report.

e. Verification. Note the software or method used to verify sufficiency of the intersection to accommodate turning movements of the design vehicle.

f. Right-of-Way. Indicate if proposed right-of-way limits for the intersection are preliminary.

g. Other. A cell is available for additional information not listed elsewhere that will add information relevant to the operation of the intersection, address unique policies or regulations, and/or aid in the review of the IDS.

3. Capacity Analysis. Perform and document the capacity analysis of the IDS according to the following guidelines:

a. Source Document. Use the *Highway Capacity Manual* and the *Highway Capacity Software* (distributed by the McTrans Center for Microcomputers in Transportation) for the capacity analyses. The use of any other capacity techniques and software must be first approved by BDE; see Section 36-1.07.

b. Signal Phasing. For signalized intersection, illustrate the proposed signal phasing for the level of service determined from the capacity analysis in diagrammatic form. Orient the signal phasing diagram to be consistent with the plan view of the intersection and any other pertinent diagrams.

c. Results. Document the data and results of the capacity analysis for each leg of the intersection. Use Figure 14-3.A for a signalized intersection, Figure 14-3.B for a roundabout intersection, Figure 14-3.C for an all-way stop-controlled intersection, and Figure 14-3.D for a two-way stop-controlled intersection.

4. Traffic Data. Provide the following traffic data on using the format illustrated in Figure 14-3.E:

a. Traffic Movements. Provide a tabular listing of all movements to and from each leg of the intersection during the a.m. and p.m. 30th maximum hour for the

existing and design years. . Also, prepare a traffic diagram for the design year showing all 30th maximum hour movements within the intersection. Orient the traffic diagram to be consistent with the plan view of the intersection and any other pertinent diagrams.

b. Percent Truck Traffic in 30th Maximum Hour. Provide the percentage of vehicles with more than 4 wheels touching the pavement..

c. Estimated Percent Increase. Include the percent of traffic increase between the existing year's traffic and the design year's traffic.

5. Intersection Layout and Design. Provide the following intersection layout and design information on the cover sheet and, if necessary on subsequent sheets:

a. Centerline. Show the centerline information for all proposed and existing curves within the immediate area of the intersection. Include superelevation rates and transition stations. Label the station equation for all intersecting side roads.

b. Angle. Note the angle of intersection between the two intersecting roadways and between the roadways and side roads.

c. Location Map. Provide a small scale location map, covering a sufficient area to properly identify the location of the improvement. It should portray the existing street or local road network and any municipalities adjacent to the improvement. Layout the map with North in the same direction as shown on the intersection layout.

d. Auxiliary Lane Lengths. Indicate lengths for all auxiliary lanes.

e. Widths and Dimensions. Include lane, median, driveway, and sidewalk widths. Include the radii for all curb returns and offsets for two and three center curb returns.

f. Tapers. Indicate all taper lengths and rates.

g. Scales. Provide a bar scale on each sheet.

h. Topographic Features. Indicate all limiting topographic features or cultural developments including:

- existing and proposed access driveways;
- existing and proposed right-of-way lines and any access control limits;
- property lines;
- property identification numbers, business names, land uses, and buildings;
- sidewalks, curb ramps, and other accessibility requirements, see Chapter 58; and

- other factors controlling the intersection design (e.g., retaining walls, utilities, gasoline pumps, other appurtenances).

i. Signals. Show the proposed signal and controller locations and signal phasing diagram. Prepare these according to the criteria and guidelines presented in Chapter 57. This information will ensure compatibility with other design elements, right-of-way, and traffic flow (progression).

j. Signs. For complex intersections, show the proper placement of signs and traffic control devices. Because signing distance and legend requirements could influence the design of complex facilities, include a preliminary signing plan with the IDS for all complex intersection designs.

k. Striping. Include the proposed striping details on the IDS as well as on Phase I plan sheets.

l. Control Points. Provide the station and offset of all control points, including all island noses, radius return points of curvature and tangency, and centerline or baseline control points.

6. Title Block. Only the individual personally responsible for the intersection design will occupy the “Designed By” line in the title block.

SIGNALIZED CAPACITY DESIGN ANALYSIS													
Program used: _____, version:_____ Signal type: _____ Area type:_____ Number of phases: (a.m.)_____ (p.m.)_____ cycle length: (a.m.)_____ (p.m.)_____ Peak hour factor: _____ Intersection delay/level-of-service a.m. _____ sec. LOS _____ p.m. _____ sec. LOS _____													
APPROACH													
Lane group													
Number of lanes													
20___ 30th max. hour traffic (veh/h)	a.m.												
	p.m.												
Base saturation flow rate (veh/h)													
Lane width (ft)													
Volume of right turn on red (veh/h)		am	pm		am	pm		am	pm		am	pm	
Pedestrians/hour (ped/h) Count or estimate		am	pm		am	pm		am	pm		am	pm	
Arrival type													
Lane utilization adj. factor													
Green time (seconds)	a.m.												
	p.m.												
Green ratio (g/C)	a.m.												
	p.m.												
Capacity (c)	a.m.												
	p.m.												
v/c ratio (X)	a.m.												
	p.m.												
Storage queue (feet or vehicles)	a.m.												
	p.m.												
Lane group delay (seconds)	a.m.												
	p.m.												
Lane group level-of-service	a.m.												
	p.m.												
Approach delay (seconds/vehicle)	a.m.												
	p.m.												
Approach Level-of-service	a.m.												
	p.m.												

SIGNALIZED CAPACITY DESIGN ANALYSIS

Figure 14-3.A

Roundabout Capacity Design Analysis													
Program used: _____ Version: _____ Area: _____ Peak hour factor: _____ Intersection control delay: a.m. _____ seconds p.m. _____ seconds **Intersection level of service: a.m. _____ p.m. _____**													
Approach													
Lane group													
20__ 30th max. hour traffic	a.m.												
	p.m.												
Entry flow rate $v_{i,pce}$ (pc/h)	a.m.												
	p.m.												
Ped/hour crossing the approach	a.m.												
	p.m.												
Lane movements													
Entry flow rate v_i (vph)	a.m.												
	p.m.												
Lane capacity c_i (vph)	a.m.												
	p.m.												
x_i (v_i/c_i ratio)	a.m.												
	p.m.												
Storage queue length (feet or vehicles)	a.m.												
	p.m.												
Lane delay, d (sec)	a.m.												
	p.m.												
Lane level of service	a.m.												
	p.m.												
Approach control delay, d (sec)	a.m.												
	p.m.												
Approach level of service	a.m.												
	p.m.												

ROUNDABOUT CAPACITY DESIGN ANALYSIS

Figure 14-3.B

ALL-WAY STOP-CONTROLLED CAPACITY DESIGN ANALYSIS													
Program used: _____, version:_____ Peak hour factor: _____ Intersection control delay: a.m._____ p.m._____(sec.) Intersection level-of-service: a.m._____ p.m._____													
APPROACH													
Major or minor leg?													
Lane group													
Number of lanes													
20___ 30th max. hour traffic (V_i) (veh/h)													
v/c ratio ($v_i/c_{p,x}$)	a.m.												
	p.m.												
Storage queue (feet or vehicles)	a.m.												
	p.m.												
Lane control delay (seconds)	a.m.												
	p.m.												
Lane level-of-service	a.m.												
	p.m.												
App. control delay (seconds)	a.m.												
	p.m.												
Approach level-of-service	a.m.												
	p.m.												

ALL-WAY STOP-CONTROLLED CAPACITY DESIGN ANALYSIS

Figure 14-3.C

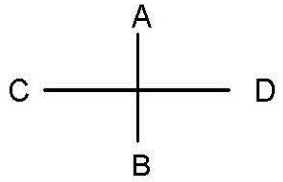
TWO-WAY STOP-CONTROLLED CAPACITY DESIGN ANALYSIS													
Program used: _____, version:_____ Peak hour factor: _____ Signalized intersection(s) within 0.25 miles of intersection along major route? (yes/no) _____ Flared approach for minor street right-turning vehicle (yes/no): _____ on the _____ approach._____ on the _____ approach. Single or two-stage gap acceptance? _____.													
APPROACH													
Major or minor leg?													
Lane group													
Number of lanes													
20___ 30th max. hour traffic (V_i) (veh/h)	a.m.												
	p.m.												
Pedestrians/hour (ped/h) count or estimate?	a.m.												
	p.m.												
Capacity ($c_{p,x}$ or c_T) (veh/h)	a.m.												
	p.m.												
v/c ratio ($v_i/c_{p,x}$)	a.m.												
	p.m.												
Storage queue (no. of vehicles)	a.m.												
	p.m.												
Control delay (seconds)	a.m.												
	p.m.												
Lane group level-of-service	a.m.												
	p.m.												
Approach delay (seconds)	a.m.												
	p.m.												
Approach level-of-service	a.m.												
	p.m.												

TWO-WAY STOP-CONTROLLED CAPACITY DESIGN ANALYSIS

Figure 14-3.D

TRAFFIC DATA										
Movement	Year 20____ 30th Maximum Hour Traffic		% Truck Traffic in 30th Max. Hr.		Est. % Increase by 20____	Year 20____ 30th Maximum Hour Traffic		Est. % Increase by 20____	Year 20 ___ 30th Maximum Hour Traffic	
	A.M.	P.M.	A.M.	P.M.		A.M.	P.M.		A.M.	P.M.
AD (L)										
AB (T)										
AC (R)										
BC (L)										
BA (T)										
BD (R)										
CA (L)										
CD (T)										
CB (R)										
DB (L)										
DC (T)										
DA (R)										
TOTAL A										
TOTAL B										
TOTAL C										
TOTAL D										

T = Through, L = Left, R = Right



TRAFFIC DATA SUMMARY

Figure 14-3.E

14-4 INTERSECTION DESIGN STUDY PROCESSING

Intersection design studies (IDS) are normally prepared under the direction of and approved by the District Geometrics Engineer. Upon completion of the IDS, it is approved by the district as illustrated in the signature block in Figure 14-2.A and included in the Phase I report. BDE will review and approve IDS's if requested by the district or if the district does not have a qualified Geometrics Engineer. The procedure to qualify a District Geometrics Engineer is discussed in Section 11-9 and Departmental Policy D&E-24.

When projects require an IDS, the district should not conduct public involvement activities without a completed IDS which reflects the most recent design alternatives. When an IDS is prepared by a qualified Geometrics Engineer, reviewed according to current geometric design policies, and approved by the District Geometrics Engineer, it may be included as part of the Phase I report. Upon approval of the IDS, the district will submit a completed BDE 2602 template to BDE for status information of the IDS.

Final approval of an IDS is given with the design approval of the final Phase I report. This ensures the consideration of social, economic, and environmental factors and public comments that could affect the design elements of an intersection. In addition, a crash analysis and relevant collision diagrams may be reviewed concurrently with the IDS.

If intersection conditions are complex, the district, at its option, may forward the IDS to BDE for early review. In this case, the IDS is reviewed with particular emphasis on compliance with accepted design practices, methods of managing or controlling access, intersection capacity, signal phasing, operational safety, efficiency, and any needed design exceptions. BDE may recommend changes to the IDS. If changes are recommended, the comments are forwarded to the district for revision. After the revised IDS is reviewed and considered satisfactory, it is then approved by the District Geometrics Engineer or BDE for inclusion in the Phase I report.